ABSTRACT

Murphy Oil Co Ltd. is the operator of two Production Sharing Contract (PSC) blocks offshore the state of Sarawak in Malaysia. The two blocks (up to 45m water depth) cover an area of approximately 10,500 sq. km of which almost half of that area is covered by 3D seismic acquired after 2000. The main reservoirs in the basin are Middle to Early Miocene lower coastal/deltaic sands located at depths of 1km to 2km.

This paper gives an example of how a prospect screening and high grading workflow has been applied in this acreage. The first step of the workflow is to establish knowledge of the AVO response of major hydrocarbon reservoirs in the nearest offset well (well D) through fluid substitution and forward modelling. Using this knowledge seismic gathers from the 3D seismic data were rapidly scanned to high-grade areas that are hydrocarbon prospective i.e. prospect M in this example. The second step in the workflow was to screen the prospective areas based on a Relative Elastic Inversion (REI) processed seismic data as an alternative or support to AVO screening. A comparison of the REI dataset of the entire seismic cube with a location specific Field-based Elastic Inversion (FEI) generated using data from only well D was made after drilling prospect M. The result shows good agreement between the two datasets and the well results. Prediction of gas, oil and water for specific reservoirs in well M were confirmed by the post-drill results.

The workflow presented should be viewed as an integral part of prospecting and should not replace sound evaluation of trap, reservoir and charge that underlies all prospect maturation work. Caution must be put up front to minimize possible false AVO response. Although REI can be used on a large scale for exploration purposes as an alternative to seismic AVO it should be followed by smaller-scale FEI for further reservoir characterization.

METHOD

Previous work in the area on AVO well modelling (Van de Coevering et. al., 2005) is continued for the field under investigation in this paper. This was done for the only well available at the time, well D, which had no recorded shear sonic log. Hence this was estimated using regional information. A deviated well M is proposed for further exploration: see Figure 1. After investigation of the AVO response at the various reservoir levels in well D and comparison against the seismic gather response, a preliminary qualitative fluid prediction is done using the seismic gathers at well location M.

For the purpose of spotting further exploration potential, a large scale layered 3D seismic simultaneous elastic inversion (for a short introduction on the inversion scheme see for example Reiser et. al., 2004) was done for the whole survey covering 1540 km2 (versus 100 km2 for the area with wells D and M) and a two seconds two-way-time interval. Therefore, the potential of proposed well M could now be judged with more advanced elastic attributes (acoustic impedance, shear impedance and the ratio of seismic acoustic and shear wave velocities (VP/VS ratio)). As this elastic inversion was very large scale, no detailed enough model could be built valid for all locations. In order to understand the seismic response, map trends and identify anomalies, no complex initial model (which can have an incorrect bias) was input: